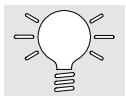
Functional Description

2

Chapter 2

explains the machine principle and describes its function in normal conditions.

Furthermore it describes the structure and function of individual assemblies.



Chapter 2

List of Contents

1 System Overview 1

1.1 System Components 1

1.2 System Data Flow 5

2 ADC-QS Server Station 6

2.1 Technical Specifications of the ADC-QS Server Station 6

2.1.1 Hardware 6

2.1.2 Software 6

2.2 Software Architecture 7

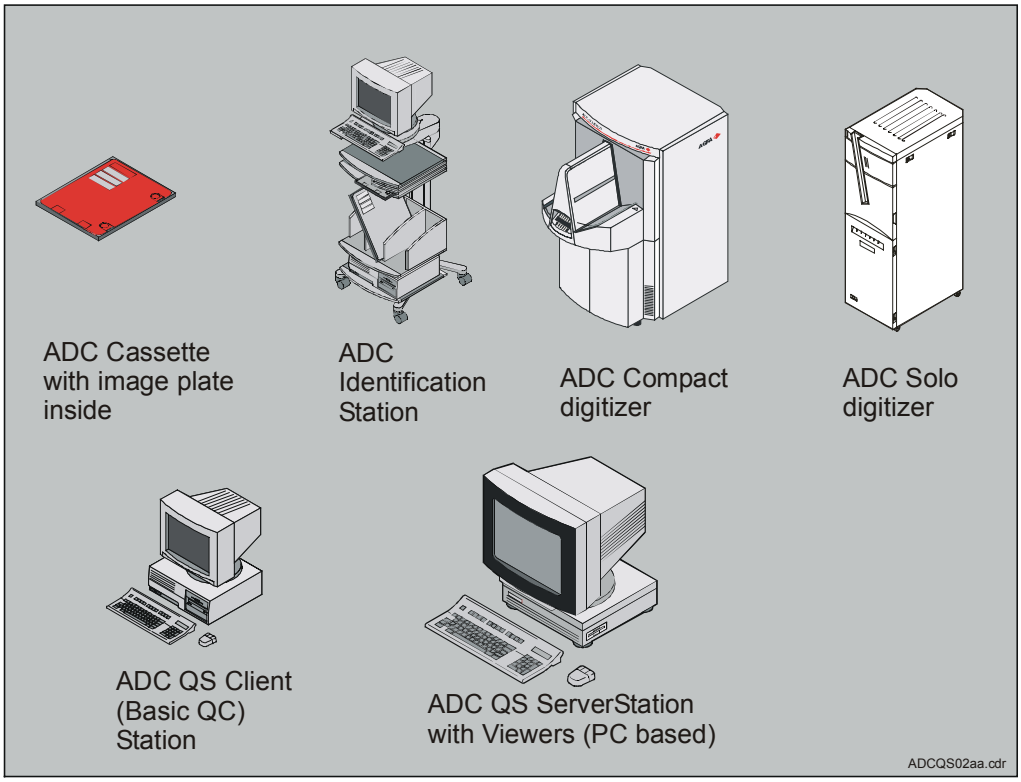
2.2.1 Software Main Components 9

2.2.2 Hard Disk Partition Layout 26

1 System Overview

This chapter gives a short overview of the complete ADC system. Further on, the internal functionality of the ADC-QS Server Station (PC-based) is discussed.
For a description of the user related topics please refer to the ADC user manuals.

1.1 System Components


ADC Cassette with image plate inside
ADC Identification Station
ADC Compact digitizer
ADC Solo digitizer
ADC QS Client (Basic QC) Station
ADC QS ServerStation with Viewers (PC based)
ADCQS02aa.cdr

System components

Image Plate The image plate takes the place of the X-ray film in an conventional system. It receives the X-Ray radiation and “stores” a latent image. The image plates can be reused thousands of times. The actual restriction of utilization is the mechanical robustness.

ADC Cassette The ADC cassette is the “container” for the image plate. During the handling outside the Digitizer (e.g. exposing the plate) the image plate is in the cassette. It is only opened inside the Digitizer. The ADC cassette has an internal chip card which holds the cassette, patient, examination and routing data belonging to a certain x-ray exposure.

Identification Station

The Identification Station is used to write the cassette, patient, examination and routing data to the cassette chip. This data can be entered manually or by retrieving the data from a Hospital or Radiology Information System (HIS/RIS).

By means of a so called Identification Tablet (ID-Tablet) the data is transferred to the chip. Writing and reading is done by means of radio frequency in a contactless manner.

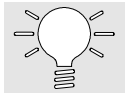
The Identification software is an AGFA product and is running on MS-Windows based operating systems (WIN95/98, WinNT4.0). Please not if you want to run ADC-QS (Basic) QC-Viewer on the same PC you have WinNT installed.

Digitizer

The Digitizer is used to read the latent image in the image plate. After the ADC cassette is exposed and identified it is inserted into the Digitizer. The Digitizer reads the data on the cassette chip, opens the cassette, takes out the image plate and scans it. The latent image on the image plate is stimulated by means of a laser beam to emit light according to x-ray exposure.

The data from the cassette chip is used to set the scan parameters correctly (e.g. speed class, image plate size, etc.) for this individual x-ray exposure. The emitted light is converted into a voltage and then digitalized into a 12bit, square root compressed raw image. This image is transmitted together with the chip data on the fly via Ethernet to the ADC-QS Server Station. A backup of that image is made on the internal hard disk in parallel to retransmit the image in case off transmission problems. The output format of the Digitizer is DICOM SCU-CR.

After scanning / transmitting is finished the image plate is erased with very bright light to make it ready for the next exposure. It is put back into the cassette and a status flag on the cassette chip is set from “EXPOSED” to “ERASED”. The cassette is returned to the user and is ready for the next examination.



ADC-QS Server Station

The ADC-QS Server Station receives the raw image from the Digitizer. Every incoming image is converted from a raw image into multi scale or pyramidal image format by the Gateway component of the ADC-QS Server Station. The thus converted images are stored on the internal hard disk(s) on the ADC-QS Server Station. In addition the Gateway component takes care that necessary database entries are performed on the ADC-QS Server Station.

However the ADC-QS Server Station provides only short term storage. The final archiving must be realized either by hardcopies or a PACS. Later also the ADC-QS Server Station will provide an archive possibility (not in major Release 1).

Further on the ADC-QS Server Station decodes the routing data and sends the image data to the selected destinations (e.g. Printer or a DICOM destination).

For the ADC-QS Server Station a lot of licensed software options (e.g. Black Border, Annotation, Smart Print, etc.) exist.

The ADC-QS Server Station is an NT-based PC with the **ADC Q**uality **S**ystem software installed (ADC-QS).

ADC Client / Basic QC Station

The ADC Basic QC Station software allows basic viewing on some other actions on the studies stored on the ADC-QS Server Station. It is included in the basic package and provides fast access to new incoming images. It is comparable with the former Preview Station.

To get more sophisticated viewing additional ADC-QS software options have to be purchased.

The ADC Client (Basic QC) Station allows the user to release the patient rather quickly from the examination session.

Several ADC Client (Basic QC) Stations can be served by one Server Station. The ADC Client (Basic QC) Station software may run on the same PC-Hardware as the Identification Station software but it also may run on a separate PC.

The ADC Basic QC Station software is an AGFA product and is running on WinNT4.0

ADC QS Viewers

ADC-QS Viewers are software components which provide the user with all kind of viewing applications for CR-studies. Some of them are included in the basic software package (e.g. ADC QS Basic QC Viewer) others have to be purchased separately.

The following ADC-QS Viewers are existing at the moment:

ADC QC Viewer:
this is an extended version of the ADC Basic QC Station with more functionality

IPD-Viewer:
Viewer which allows all kind of image manipulation like MUSICA image processing

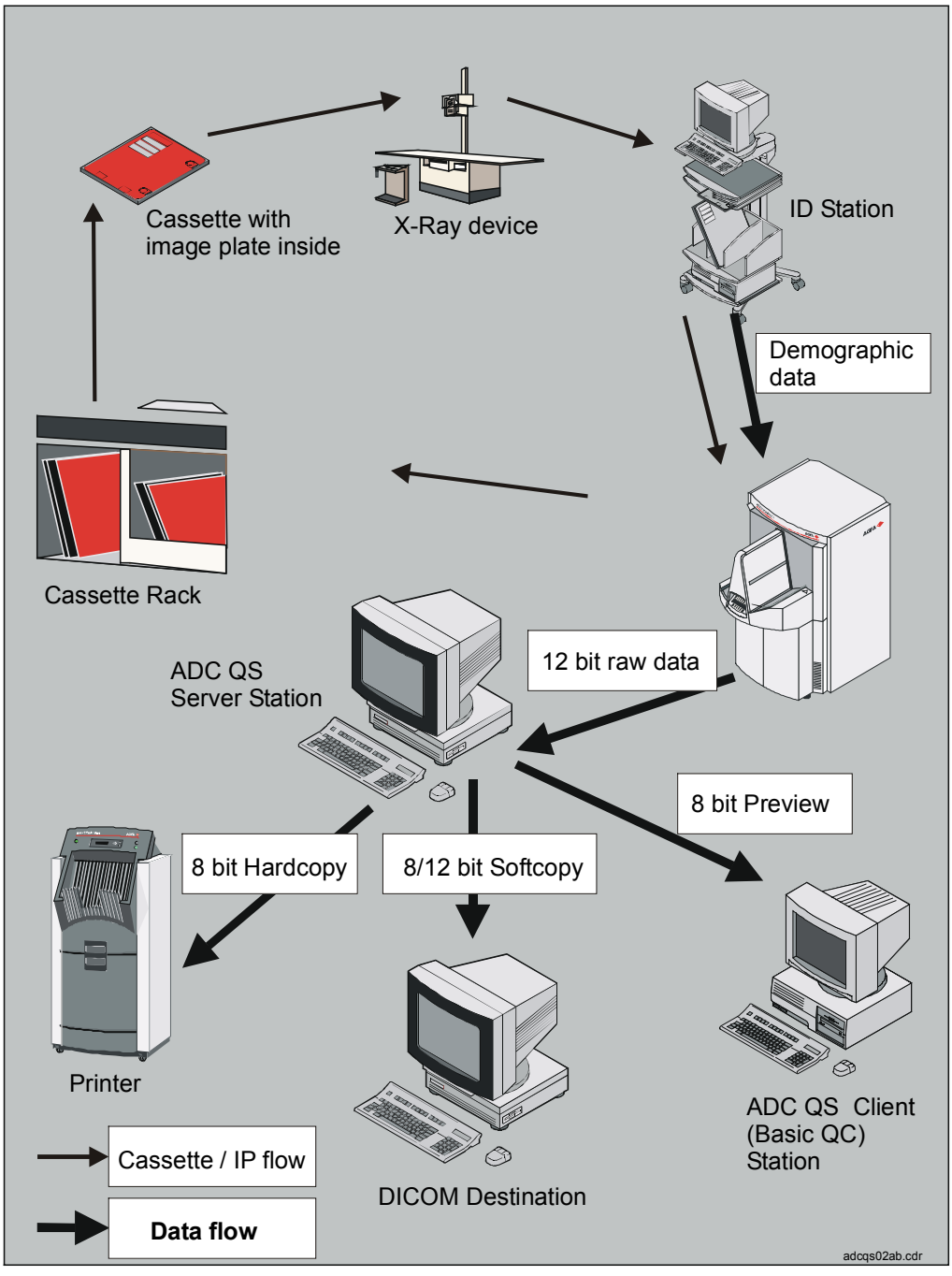
Selector:
Viewer to get an overview over the studies available on the ADC-QS Server Station. Study display may be character oriented and/or with thumbnail images.

Configuration Viewer:
Viewer to configure the ADC-QS Server Station

Print Composer:
Viewer to configure and manage ADC-QS Server Station

1.2 System Data Flow

For more information about the ADC-System operation refer to the ADC User manuals as well.



System Data flow

2 ADC-QS Server Station

The ADC-QS Server Station is the center of the ADC Quality System. There all the data (image and demographic) arrives and the whole administration happens. The following main tasks can be distinguished:

- Reception of images (DICOM SCP-CR)
- Automatic processing of the images according to the examination
- Storage administration for the images on the local hard disks (only for short term storage)
- Demographic data management by ORACLE relational data base management system (rdbms)
- Preparing and transmitting image data for output to different destination types (e.g. HCP (DICOM SCU Print), including automatic routing.
- Queue management
- Intuitive User Interface (Viewers) to do all kind of image manipulations for the user (e.g. change image processing, apply annotation, system monitoring and set up, configurable search and filter criteria, view and edit patient demographics, print layout configuration system, etc.).
- Error and warning message management with logging functionality (NT-Event Viewer).

2.1 Technical Specifications of the ADC-QS Server Station

2.1.1 Hardware

2.1.1.1 ADC-QS Server Station – Server / Standalone

- DELL Server Hardware with floppy drive, CD-ROM drive and two SCSI hard disks inside. The ADC-QS Server Station HW may change during the course of time.
- Standard Brightness Monitor (21”, 8-bit grayscale monitor)
- Please refer to chapter 14 for more information

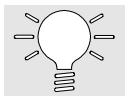
2.1.1.2 Optional Hardware

- High Brightness monitor (21”, 8 bit-grayscale monitor)
- Uninterruptible Power Supply (UPS) with 700 VA
- ADC Test Phantom Set
- ADC Standard PC for network client application of ADC QS Viewers
- Please refer to chapter 14 for more information

2.1.2 Software

2.1.2.1 Basic Software Modules

- *Microsoft Windows NT4.0 Server/Workstation



- Microsoft Windows NT Service Pack 6A
- **Microsoft Windows Scripting Host
- **Microsoft Windows NT Task Scheduler
- Microsoft Internet Explorer 5.5 (IE5.5)
- Microsoft Java Virtual Machine
- **Microsoft Internet Information Server (IIS)
- **ORACLE referential database management system (Enterprise Edition)
- Symantec PC-Anywhere
- AGFA application ADC-QS software(ADC **Q**uality **S**ystem) or ADC-QS Online Processing software

*The NT Workstation version is used on client stations only while the NT Server version is only used on the ADC_QS Server / Standalone.
**Components only installed on the ADC_QS Server / Standalone.

2.1.2.2 Optional (AGFA) software

- ADC IDP Viewer Software
- ADC QC Viewer Software
- ADC Autorouting Software
- ADC Uro/Tomo Software
- ADC Pediatric Software
- ADC DICOM Store Connection
- ADC Dental Software
- ADC Smart Print Software
- ADC Annotation Software
- ADC Black Border Software
- ADC Multi-Format Import/Export Software
- ADC Full Leg/Spine Software
- ADC QC Software
- ADC Dose Monitoring Software

The list of options may vary during the time. The above mentioned option maybe released for different software versions. In addition the list shows all options planned at the moment this document was created. Please follow the news distributed by AGFA to check what is released and what not.

2.2 Software Architecture

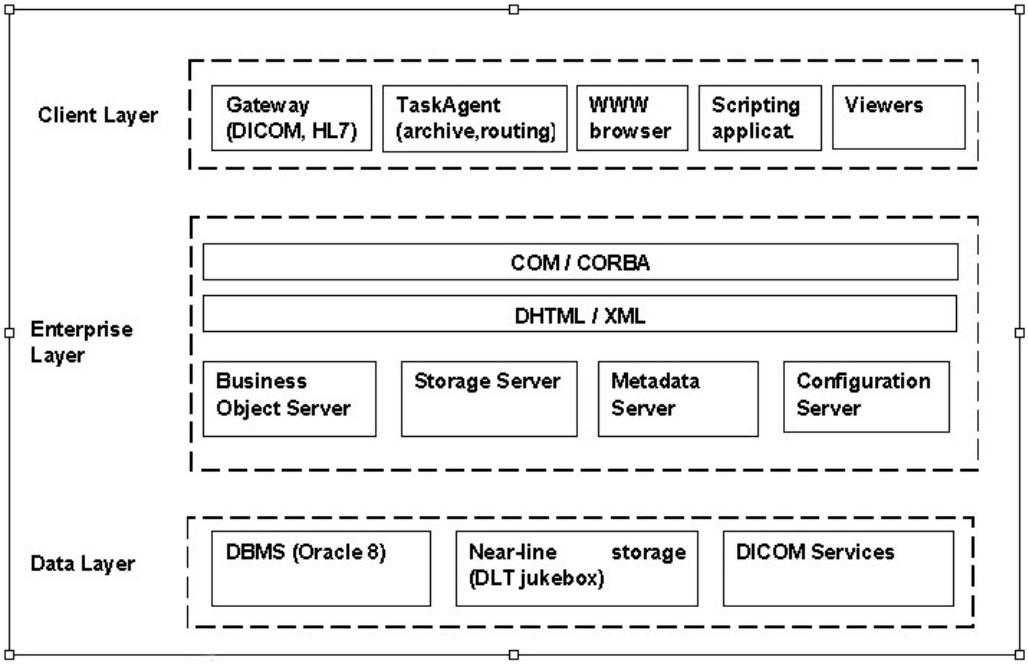
The ADC QS Server Station is based on PC Hardware and runs on the Microsoft NT operating system.

The management of the demographic data is done by a rdbms (**r**elational **d**ata **b**ase **m**anagement system) from ORACLE.

The ADC-QS software is the AGFA part of the software running on the Server Station. The rest is standard software from different vendors (Microsoft, ORACLE, Symantec, etc.).

The ADC-QS software consists of three independent layers (three tier Architecture).

- Client Layer
- Enterprise or Business Layer
- Data or Storage Layer

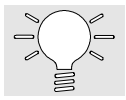


As the three different layers are communicating through standardized interface like COM or ODBC modules can be exchanged without having to adapt modules form other layers.

The client layer contains all the modules the user sees and interacts with (e.g. Viewers, Task Manager, DICOM CR-Store SCP Gateway, etc.). All tasks initiated on this layer are forwarded through the COM / DCOM layer to the Enterprise Layer.

The Enterprise or Business Layer contains the application logic. This means it manages and administers all the tasks and actions to be performed with a study. Studies in ADC-QS terms are also called *Procedure Steps* or *Business Objects*. It

- Creates the database entries for a new incoming study according to the healthcare object model.
- Takes care about storing the images on the local / near-line storage.
- Takes care about status information for a certain study
- Administrates all configuration issues.
- Triggers tasks like routing, printing or sending.



- Manages updates of study demographic data.
- Notifies the Viewers about new incoming images.
- Forwards queries issued by means of the Viewers.
- Handles any requests coming from the upper layer
- Does image processing
- Does DICOM store

The Enterprise or Business Layer is the "switchboard" of the ADC-QS system. This layer is represented by a bunch of server modules, dedicated for special tasks. This layer is also called the COMPAS Server component.

The Data or Storage Layer is managed by the Enterprise or Business Layer as well. Here the actual data is stored. Demographic data is stored in the ORACLE database, pixel data is stored on the local hard disk or in an near-line storage device.

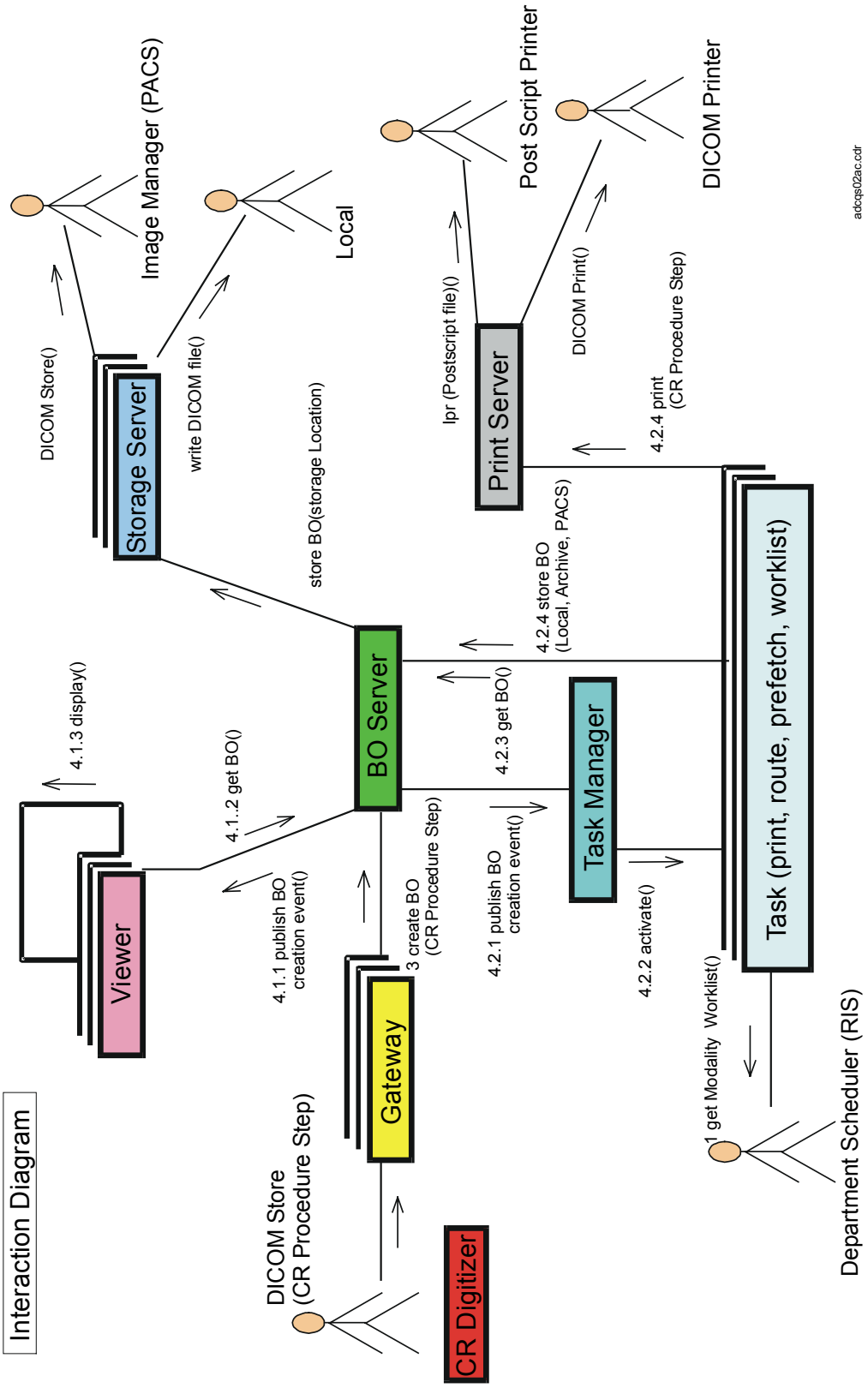
2.2.1 Software Main Components

The ADC-QS system consists of a set of components:

- Viewers
- Task Manager
- DICOM gateway for DICOM CR SCP
- Business Object Server
- Print Server
- Message Server
- Configuration Server
- Web Server

The components are located on one PC or are distributed over multiple PC's (not possible in first customer release). The components communicate with each other, using the COM/DCOM messaging framework of Windows NT. COM/DCOM is both used for stand-alone configurations as for distributed configurations. As a result there is not distinction (from software point of view) between a stand-alone configuration and a distributed configuration. Of course it has an impact on performance. (See Interaction Diagram).

Module Name	Program in NT Task Manager	Logging source in NT Event Viewer	Tasks
Gateway	gw2_r.exe	NEWGATEWAY	Receive CR-studies Convert DICOM stream to healthcare model Forward CR-Study to BOS
Business Object Server, Print Server, Message Server, Config. Server, Storage Server, Image Processing Server	compasserver.exe compaslogger.exe compasmsgmg.exe	BOSERVER	Connection to database at startup Image processing Creation/modification of database entries for CR-studies and Configuration Objects. Querying the database Create and send DICOM softcopies to PACS systems. Logging and displaying messages
Task Manager	tmservrr.exe tmcontxr.exe	TASKMANAGER	Managing background tasks like storage management, routing, etc
Dicom Port Monitor	Portmap.exe Spoolss.exe	DICOMPRINT	Creates DICOM images from Postscript files
Viewer Fram.	CRViewer.exe	CR-ENTRY	User interface frames
IPD-Viewers	Viewer.exe	CR-ENTRY	Image Processing Display
QC-Viewer	QCViewer.exe	CR-ENTRY	Quality Control
Selector	Selector.exe	CR-ENTRY	Character based patient listing
Configuration Viewer	ConfigView.exe	CR-ENTRY	Configuration tool for configuring ADC-QS
PrintComposer	PRINTC~.EXE	CR-ENTRY	UI for creating print composition
BOExplorer	BOExplorer.exe	No logging	Browser for database entries


Interaction Diagram
Image Manager (PACS)
Local
Post Script Printer
DICOM Printer
DICOM Store()
write DICOM file()
lpr (Postscript file)()
DICOM Print()
Storage Server
Print Server
store BO(storage Location)
4.2.4 print
(CR Procedure Step)
4.2.4 store BO
(Local, Archive, PACS)
4.1.3 display()
BO Server
4.2.3 get BO()
4.1..2 get BO()
Task Manager
Task (print, route, prefetch, worklist)
Viewer
4.1.1 publish BO
creation event()
3 create BO
(CR Procedure Step)
4.2.1 publish BO
creation event()
4.2.2 activate()
Gateway
1 get Modality Worklist()
DICOM Store
(CR Procedure Step)
CR Digitizer
Department Scheduler (RIS)
adcqs02ac.cdr

2.2.1.1 Viewers

Please see the user manuals for a description of the different Viewers and their functionality.

2.2.1.2 DICOM Gateway

2.2.1.2.1 Functionality

The DICOM gateway receives CR studies (CR Procedure Steps) from a CR modality (ADC Compact / Solo) and stores them in the Business Object Server. The gateway supports DICOM CR Image Storage SCP. The gateway is a multi-threaded application which supports multiple inputs at the same time. A listener thread waits for a DICOM association request and passes the request to a processing thread; the processing thread validates the DICOM stream and creates Business Objects in the server. Normally four processing threads are running in the Gateway.

The following tasks are managed by the Gateway component:

- Listen to the DICOM port for a requested DICOM association.
- Open DICOM association to CR-modality.
- Receive CR-studies from the CR-modalities.
- Converts the received DICOM data stream into the internal format (healthcare model) of the ADC-QS.
- Forward the images of a CR-study to the BOS.
- Closes the DICOM association after a CR-study has been transmitted successfully.

For the first release the Gateway always resides on the same machine as the Business Object Server or ADC-QS Server machine. In later releases the Gateway component may run on different machines for load balancing reasons.

2.2.1.2.2 Configuration

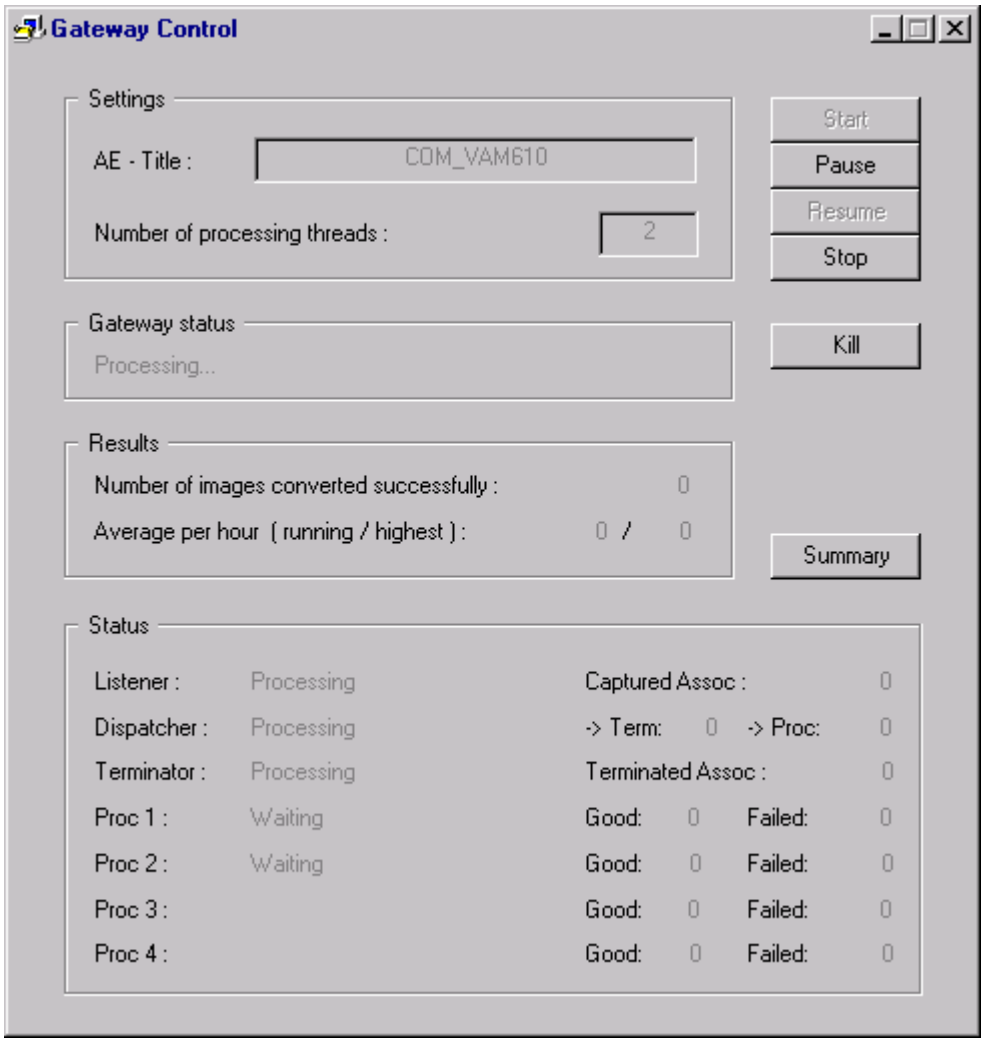
The Gateway is configured by means of the cpf-file. Later on the Configuration Viewer will be used for that purpose.

The mapping between the DICOM attributes and the Business Object properties is described in a file. There the mapping for all DICOM Inputs and DICOM Storage SCU Service Class Outputs (--> PACS Systems) is done. The installed mapping file is optimized for the ADC digitizers and it is not supposed to be changed in the field.

2.2.1.2.3 Monitoring

The NT Task manager can be used to monitor the gateway process resources; process name = GW2_R.exe

The Gateway GUI is used to monitor the status and configuration of the gateway.



- Start : Start the Gateway capturing and processing Dicom objects. Note that the Gateway starts up automatically after boot.
- Stop : Stop the Gateway: no more new objects are captured and processed. SCU's cannot connect any longer to the Gateway. Server connections are terminated gently. The dialog stays open.
- Pause : Pause the Gateway: no more new objects are captured and processed but SCU's can still connect. Created associations are terminated immediately.
- Resume : Resume the Gateway: new objects are captured and processed again.
- Kill : Immediately kills all threads. Even if some threads were still processing. Server connections are NOT terminated in a proper way. You will have to kill the 'dllhost' tasks inside the Task Manager.
- Summary : Collapse the dialog only showing a dialog summary.
- 'Result' area : shows the total number of successfully converted Dicom objects and the averages. The first number is a running number: the total

divided by the time the Gateway is running. The last number is the highest average since the Gateway was started.

- ‘Status’ area. This area shows some figures for each thread inside the Gateway. Although you can have as many processing threads as you want, only four are shown.
- 'Term' shows the amount of associations that have been opened but closed immediately because no processing thread was free. No data has been captured for these associations.
- 'Proc' shows the amount of processed associations: associations where data has been accepted and stored in the BO Server.
- ‘Failed’ or ‘Success’ indicates the failed or successful completion of BO storage.

2.2.1.2.4 Logging

Logging information is sent to the NT Event Viewer. If you only want to see the Gateway entries, use the filter to specify ‘NEWGATEWAY’ as the source.

2.2.1.3 Task Manager

2.2.1.3.1 Functionality

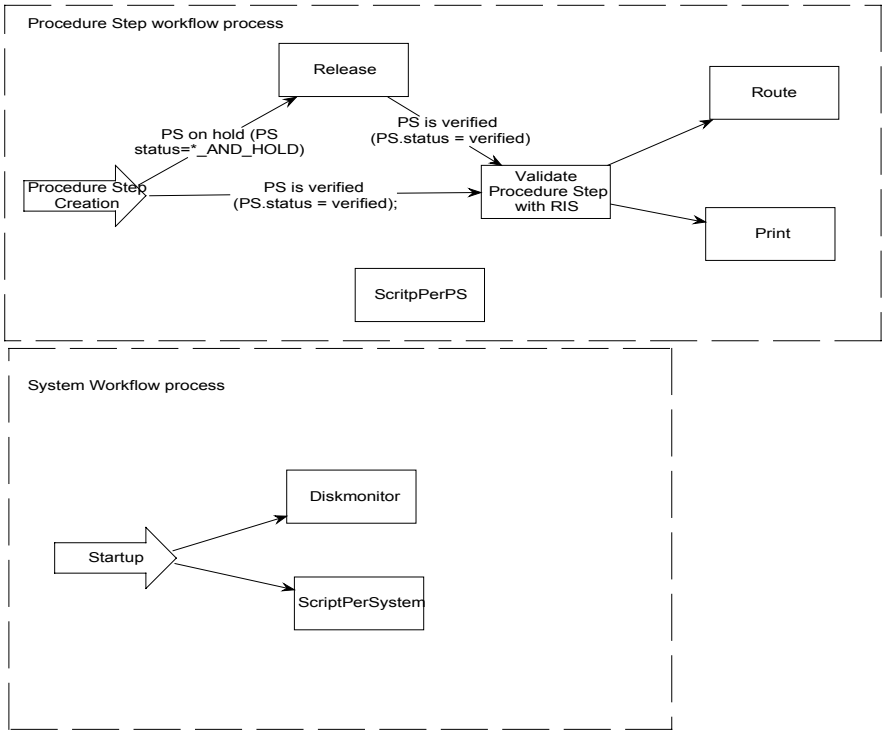
The task manager manages the different background tasks in the system.

Each task contains the following properties :

- task trigger: specifies when the task is invoked : manual, event driven (e.g. when a BO is created), periodically (at predefined time points).
- task condition (optional) : specifies the set of Business Objects on which the task apply : example : CR-Studies or Procedure Steps with **status** = VERIFIED and **routing status** = REQUESTED
- task behavior is defined in a script (Java Script).

A sequence of tasks can be performed for a particular Business Object (e.g. ProcedureStep) by assigning tasks to **status** property value (see workflow example).

The following predefined tasks are installed :



- Print task : print the incoming Procedure Steps (CR-Studies) to a DICOM or Postscript printer
- Route task : route the incoming Procedure Steps to one or more destinations
- Release task : release Procedure Steps, which are put in hold state, if the hold time exceeds the hold timeout
- Pre-fetch task : retrieve scheduled Procedure Steps from archive to local storage (Not in release 1)
- Disk monitor task : monitor the available disk space and delete Procedure Steps, based on pre-defined rules
- Backup task : backup the configuration settings and database on the second internal hard disk of the ADC-QS Server
- Performed Procedure task : Notify RIS about Procedure Step related status changes, using the DICOM Performed Procedure Step Service Class (not in Release 1).

2.2.1.3.2 Configuration and Monitoring

General

- Some tasks allow freely editing and deleting of its parameters. If these parameters are removed (by a wrong user operation), it is very hard to find back the correct parameter names. Therefore we recommend **not to edit the task parameters at all**. The default parameters are the tested ones and guarantee a proper working of the system!

If you are faced to a problem where a change of the settings may be necessary please **first contact an expert** (GSC).
If settings are already changed and the system does not run proper, please contact an expert (GSC).

- If status of a task in ADC QS task manager is ACTIVE_EXECUTING and the “Deactivate” button is used, the task status is changed to INACTIVE_EXECUTING. This is an invalid status and it is not possible to make this task running again. Prevention: Never use “Deactivate” button while task status is ACTIVE_EXECUTING.

- The Configuration Viewer task manager does not update the status of a task when it changes. The only way to verify if a task is still running is in the NT-task scheduler.

- A task only works when server is running. Editing a task while the server is not running gives an error which can not be bypassed. In order to be sure that the server is running reset ADC QS Software, also if a problem occurs reset the ADC QS Software.

QC Phantom task

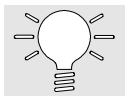
- The task manager lists QC Phantom task as ACTIVE, but this task is INACTIVE. This task is not implemented and can not be edited.

Elements of the task manager

The Configuration Viewer or the Task Browser is used to monitor the status and view the configuration of the tasks.

The NT Task manager can be used to monitor the ADC-QS task manager process resources. The process names representing the ADC-QS task manager are “tmservrr.exe” and “tmcontxr.exe”. If these two processes are not running automatic background tasks cannot be performed.

During startup the process “tmservrr.exe” checks (via the Business Object Server) in the database which tasks to start. It retrieves the task parameters and converts it into readable form for NT-Scheduler. It forwards that information to the NT-Scheduler, which in turn starts up there the tasks with the defined parameters.



After that “tmcontxr.exe” checks whether there are still jobs to be performed (e.g. CR-Studies with routing status set to “REQUESTED” and the status “VERIFIED”). If this is the case it initiates the corresponding scheduled task in the NT-Scheduler service, who finally performs the task.

In normal working the Business Object Server notifies the Task Manager to initiate actions.

The program “tmcontxr.exe” passes information between the different tasks via “tmcontxr.exe”.

The ADC-QS task manager browser is represented by the program “tmbrowser.exe”.

2.2.1.3.3 Logging

Logging information is sent to the NT Event Viewer. If you only want to see the ‘Task Manager’ entries, use the filter to specify ‘Task Manager’ as the source.

2.2.1.4 Business Object Server

2.2.1.4.1 Functionality

The Business Object Server is the core of ADC QS. There the whole management of patient demographics, status information for CR-Studies, configuration data and so forth is administered.
Business Object represents a real-world entity (e.g. patient, image, study) and is defined by a:

- set of properties : e.g. Business Object Patient contains properties like patient name, patient ID, etc...
- set of rules that define its behavior. Examples : validation rules, rules to define default values,..
- relations among Business Objects : Example : a CR-Series is the parent of an CR-Image

A Business Object Domain (BOD) describes a collection of data or Business Objects and corresponds with a particular application domain. The following domains are pre-defined :

- Healthcare domain : describes healthcare environment (patient, procedure steps, images). The DICOM model is used as the basis.
- NDT domain : describes the NDT environment (plant, components, images). A DICOM like model is used as the basis.
- Configuration domain : describes the configuration of the ADC/QS system (e.g. printer, gateway,...)

The Business Object Server contains the following sub-components :

- Metadata Server : manages the definitions (properties, rules, relations) of the different Business Object Domains. For example this may be the mapping between the DICOM groups & elements to the Healthcare application as it is structured in the database. Business Objects can be dynamically added (no need to re-compile the software)

- Business Object Services : provide to client applications (e.g. viewers) a set of services which are common to all Business Objects : e.g. query for Business Objects, create/delete Business Objects, get/set Business Object properties, Business Object event management, ..
- Image processing server : set of image processing routines (e.g. collimation, MUSICA, wall thickness measurement) that can be applied to a CR image. The complete imaging chain is described below.
- Storage server : stores the Business Object data on a logical storage location. The following storage types are supported :
  - local storage : database/file system on hard disk
  - local archive (=DLT jukebox) : only stores the image pixel data (not in first release)
  - XML file
  - DICOM storage (=DICOM Storage SCU)

The storage location specifics are hidden from the client application so that the same client code can be used to store Business Objects in the different storage location. Furthermore it is possible to support in the future new storage locations without the requirement to change client code. The different storage types are described below.

2.2.1.4.2 Configuration and Monitoring

The different Business Object domains are fully configurable and are described by a set of files. However these files normally do not have to be changed.
The Business Object Server is represented by three programs:

- **compasserver.exe** – takes care about all the interaction request with the database. At startup time it parses the information from the configuration files.
- **compasmsgmgr.exe** – creates the error messages for the message console
- **compaslogger.exe** – creates the logging in the NT-Event Viewer

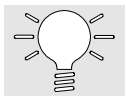
All three of them have to run, otherwise problems with the Server can be expected. The NT Task manager can be used to check this and monitor the task manager process resources;

2.2.1.4.3 Logging

Logging information is sent to the NT Event Viewer. If you only want to see the Business Object Server entries, use the filter to specify the source :

- BO Server : BO Server related logging
- ModelUpdater : Database scheme updater related logging
- Archive DB Updater : Archive related scheme updater related logging

A separate logfile exists to log jukebox related events : the loglevel and file location is configured in the Archive Administration section of the configuration viewer (default file location: c:\archive.log)



2.2.1.4.4 Storage Server

Functionality

The Storage Server stores the BO data on a logical storage location. The following storage types are supported :

- ***local storage*** : the structured information (e.g. patient name) is stored in an ODBC database; the non-structured information (e.g. pixel data files, print layout description) is stored in the file system under data directory. The current version only support Oracle 8.x as ODBC database. The database scheme is automatically created or updated from the metadata description.
- ***local archive*** : combination of local storage and a DLT jukebox : the structured information is stored in the ODBC database (cfr. local storage); the pixel data files are stored on local hard disk or in archive in a transparent way; hence the combination of local disk and archive is treated as a big file system. Files are automatically migrated from/to archive. Archiving is not supported in the first release of the ADC-QS software.
- ***XML file :*** the Business Object hierarchy is stored in a file as an XML document. The file contains both the metadata (=Business Object domain model) and the data (Business Object property values); as a result the XML file is the ideal format to import/export data among different (versions of) the ADC/QS system. The XML file can also be viewed by any XML compliant browser (e.g. IE5, Navigator 4.5). XML files are used to export/import the Healthcare Business Objects and the Configuration Business Objects. The goal is to replace the CPF files by the XML configuration files. In order to achieve backward compatibility, the current version supports the import of CPF files.

- ***DICOM storage*** : The DICOM Storage location is an DICOM CR Storage SCU and is used to send a procedure step to a DICOM archive like IMPAX. The DICOM storage supports the following image types :
  - SQRT E
  - LOG_E REL + separate VOI LUT (output values are expressed in OD_REL)
  - OD_REL
  - OD
  - P-Values (Presentation LUT is not yet supported)

For each of the image types it is possible to burn-in annotation and to apply geometrical transformations. A complete description of the meaning of the different image types is given below.

2.2.1.4.4.1 *Configuration*

The Configuration Viewer is used to define the configuration parameters of the DICOM storage location (e.g. DICOM attributes, processed image type, ..)

2.2.1.4.4.2 *Monitoring and logging*

See BO server description

2.2.1.4.5 Image Processing Server

2.2.1.4.5.1 *Functionality*

The image processing server contains a set of image processing algorithms that can be applied on CR images. The supported image processing algorithms are :

- Image rendering enhancement : creates a processed CR image; different types of processed CR images (e.g. LOGE_REL, OD, P, ..) can be created by tapping it from the different places of the imaging chain.
- Collimation
- Wall thickness measurement
- Density profile measurement

In addition, the most recently used images are cached in memory to improve the performance.
Processed Image types
The following types of processed images are supported :

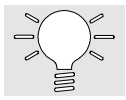


Image type	Rescale type	Rescale slope/inter-cept	VOI LUT	Window Center/ Window Width	#bits/pi-xel	Description
LOG_EREL	LOG_EREL	Slope = 1.0 Intercept = 0.0	Sensito curve + scaled to W/L; output = OD REL	-	12	Processed image
OD REL	OD_REL	slope = 1.0 intercept=0.0	-	2048/4096	12	LOG_E REL image + apply W/L and sensitometric
OD	OD	slope = 10.9804 intercept=200	-	1600/2800	8	OD_REL image + apply PresentationLUT, optimized for hardcopy
P*	P-Values	slope = 1.0 intercept=0.0	-	2048/4096	12	OD_REL image + apply Presentation LUT, optimized for human perception and device independent

* not in first release
By default, the processed image contains burned-in annotation and the geometrical transformations (rotation, flip) are already applied.

2.2.1.4.6 Print Server

2.2.1.4.6.1 Functionality

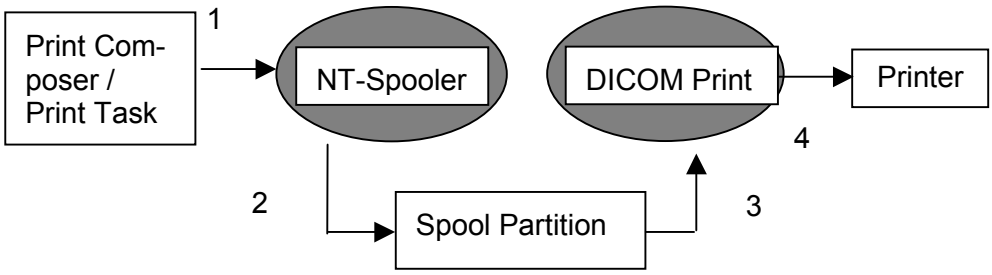
The print server is responsible for printing print jobs on a DICOM or Postscript printer and consists of the following components

- print composer : composes a page layout with images and annotation as described by the layout description (PSO stream)
- print driver : creates a postscript file, from the page layout composition
- print spooler : spools (queues) the postscript file
- port monitor : transmits the postscript file to the printer. The port monitor is printer specific:
  - The lpr port monitor uses the lpr protocol to send the postscript file to the postscript printer
  - The DICOM port monitor creates a page bitmap (4kx5k for a 14x17" film) from the postscript file using a Postscript RIP (in our case JAWS) and sends the page bitmap to the printer with DICOM Basic Print (standard layout 1/1). All the rendering is done in the DICOM port monitor and not in the printer anymore. Hence, the print result is the same on any DICOM printer.

The distinction between a postscript printer and DICOM printer is only made at the port monitor level. As a result all client applications, including desktop applications like MSWord can print on both a Postscript printer and a DICOM printer.

The printing is performed in two steps:

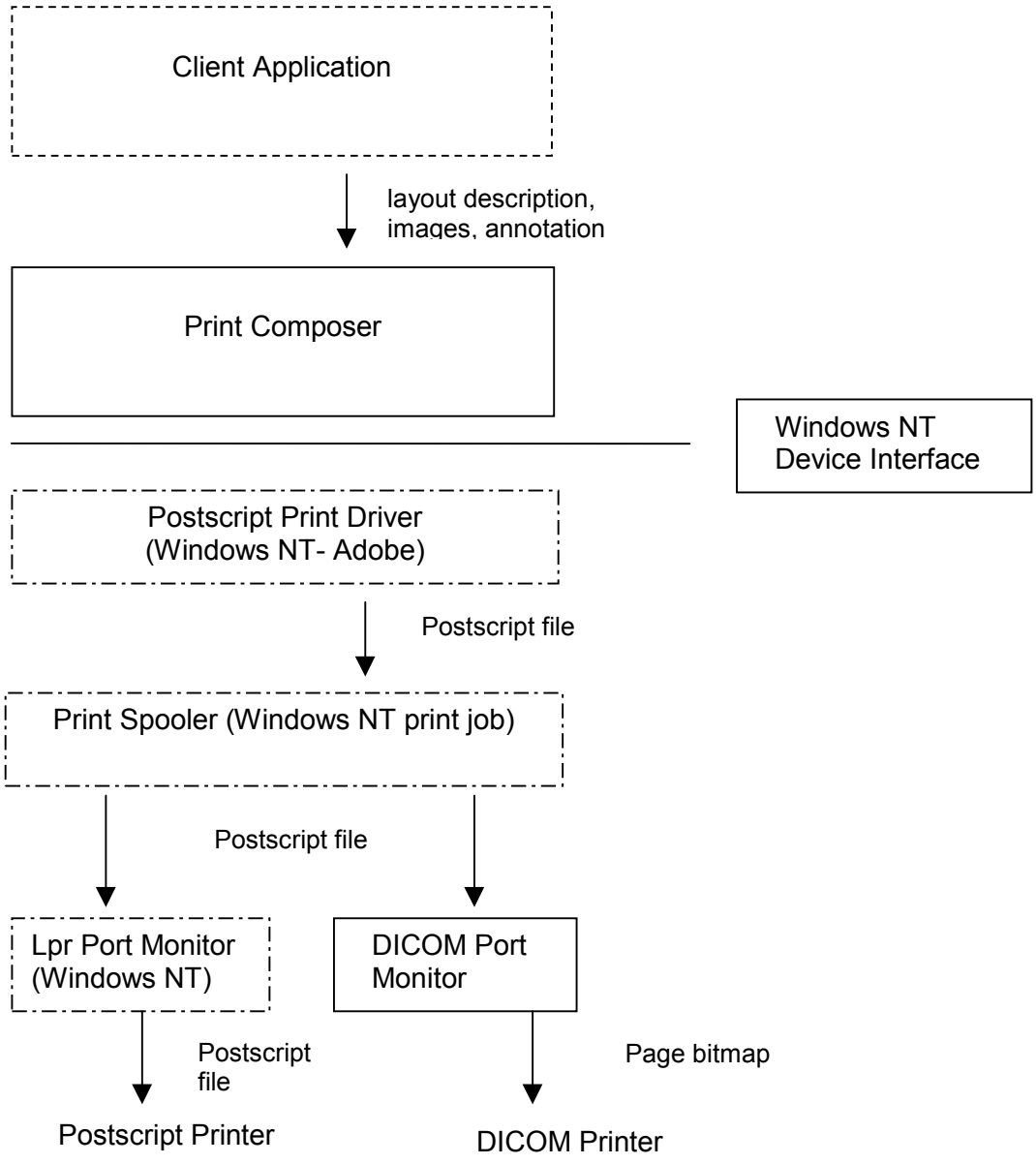
- **From the "Print Composer / Print Task" to the NT-Spooler (1,2)** – The "Print Composer / Print Task" spools the print job to the NT-Spooler on the spool partition of the ADC-QS. This is a postscript file. There is one bitmap file on the spool partition per job that is spooled but not printed. Errors occurring during spooling to the NT-partition are marked in the database setting the "Print Status" flag on "FAILED". This can happen when the spool partitions gets full. This job will not be automatically resent and has to be resent manually. If the print job is spooled successfully it will get the status "DONE"
- **From the NT-Spooler via "DICOM Print" to the Printer (3, 4)** – The "DICOM Print" application will convert the NT postscript print job into a DICOM print job and will send it to the printer. When an error occurs during this operation, the print job in the NT-spooler will get the status "failed". The printer status in the database however stays on "DONE" in the user interface.



Thus the printing can fail on two levels. If it fails somewhere in steps 1 or 2 it will be reflected in the Viewers by the print status flag set on "failed". If it fails somewhere between 3 and 4 it is reflected in the NT-spooler but not in the ADC-QS Viewer. This jobs stay on the spool partition and may fill it up as they are not deleted. Manual deletion or retransmission has to be done by the user via the NT print spooler.

Note if the print status flag for a print job has been set once in the database it is not changed anymore. Once it is on "failed" it stays on "failed" even if a second manual try has been successful. As this can be very confusing for the user it is recommended to remove that flag from the Viewers.

2.2.1.4.6.2 *Print architecture*



2.2.1.4.6.3 *Configuration*

The Adobe PPD files describe the printer capabilities and are used by the print driver to create a print job. The Configuration Viewer or cpf-file is used to define the configuration parameters of the DICOM printers.

2.2.1.4.6.4 *Monitoring*

The DICOM port monitor runs within the spooler process of NT. The NT Task manager can be used to monitor the spooler process resources; process name = spoolss.exe

2.2.1.4.6.5 *Logging*

Logging information is sent to the NT Event Viewer. If you only want to see the Business Object Server entries, use the filter to specify 'BOSERVER' as the source.

If there is an error during DICOM printing then an error will appear in the NT event viewer in system log (Source: DICOM Print).

2.2.1.4.7 Message Server

2.2.1.4.7.1 *Functionality*

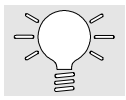
The message server stores all error/warning/.. messages from the different components in a logfile or in the NT Event logfile (default). The NT Event viewer is used to view/filter the NT Event logfiles.
The following message types are supported:

- Debug
- Logging
- Warning
- Error
- Audit

The language of the message is configurable.

2.2.1.4.7.2 *Configuration*

- It is configurable which message types will be logged (all other message types will not be stored). The default configuration is that all message types are logged except R&D debug messages.
- The log messages are language dependant, which configured by installing a language file



2.2.1.4.7.3 *Monitoring*

The NT Task manager can be used to monitor the message server process resources; process name = CompasMsgMgr.exe, CompasLogger.exe

2.2.1.4.8 Configuration Server

2.2.1.4.8.1 *Functionality*

The configuration information of the various components are stored in Configuration Objects in the database. These configuration parameters are treated like Business Objects.

For backward compatibility reasons, it is possible to import a CPF file. Most Configuration Object properties will be initialized with the corresponding CPF table properties The remaining properties (e.g. task manager parameters) are set to defaults and can be updated with the Configuration Viewer.

In addition it is also possible to export/import the configuration parameters in an XML file. This guarantees that all the configuration parameters are exported/imported.

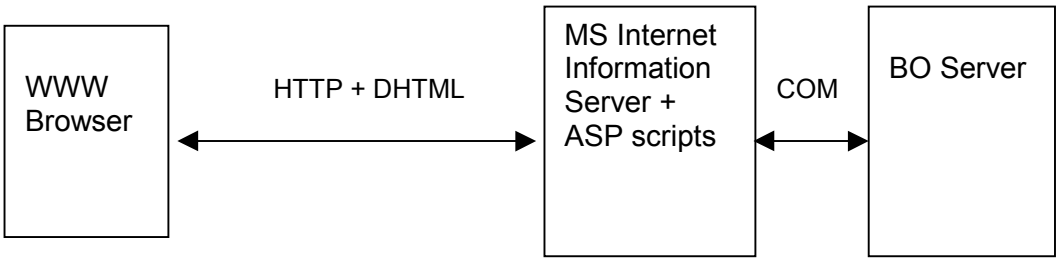
2.2.1.4.9 Web Server

2.2.1.4.9.1 *Functionality*

The Web Server is a HTML/HTTP front-end of the BO Server and Windows NT and is accessible with standard WWW browsers (e.g. IE, Navigator). The first application is to perform remote service administration.
The supported functionality is :

- Application level administration : similar to the Configuration Viewer
- WindowsNT administration
- Oracle administration

2.2.1.4.9.2 *Architecture*



2.2.1.4.9.3 *Server Configuration :*

- Local : Internet Service manager(plug-in for MS Management Console)
- Remote : Internet Service manager(HTML). This application makes use of the Windows NT challenge/Response mechanism, you can only access it with IE.

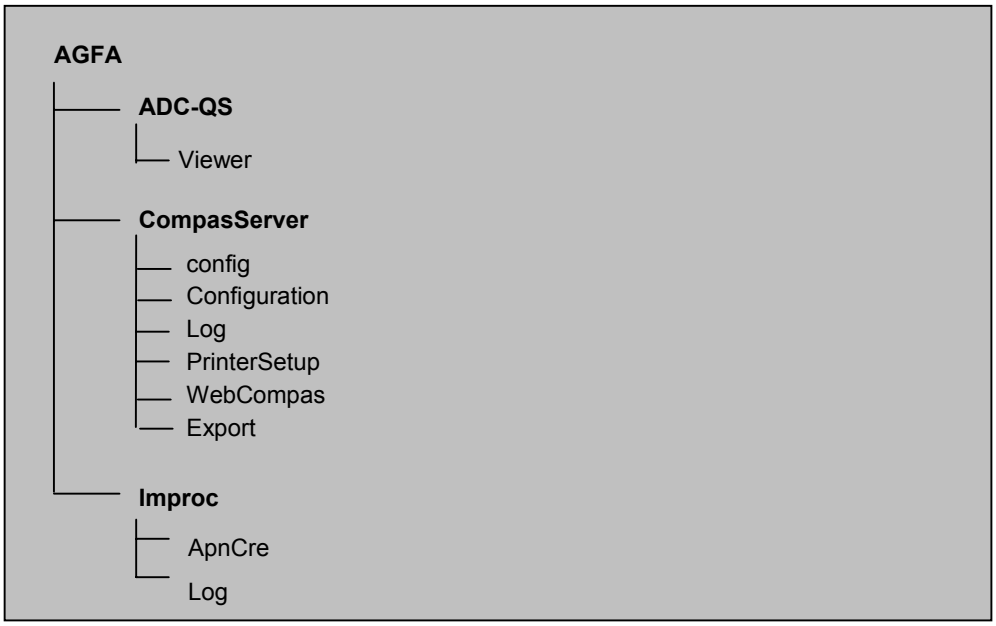
Supported WWW browsers : IE 4.x, Netscape 4.x (and higher)

2.2.2 Hard Disk Partition Layout

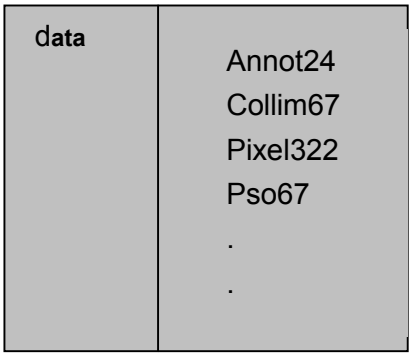
The ADC-QS Server / Standalone hardware is delivered with two internal SCSI hard disks.(momentarily 2x9.0GB). One disk contains is regarded as system disk (containing operating system, database, image spool buffer, AGFA's application software, other necessary software packages). There are two page-files or swap-files defined on the second hard disk, which also contains the data. The second hard disk should be selected for this to speed up the system.

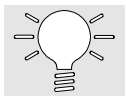
2.2.2.1 Special directories

The application software is stored under the directory "E:\AGFA".
There you find the following structure



The "ADC-QS" directory contains all the Viewer related programs and files. The "CompasServer" directory contains all the programs and files of the Business Object Server except the image processing algorithms which are stored under "Improc". Normally no actions are necessary in this directories. Under the directory "/data" the images or pixel files are stored. There you find the following structure





Normally, the “data” directory is not on the system disk. This is mostly for performance reasons. There you find four types of files:

- **Annot<#>** - This file contains the annotations which have been applied on a certain image file. The file is created during inserting images into the BOS. At that time it is empty.
- **Collim<#>** - This file contains the collimation frame.
- **Pixel<#>** - This file contains the actual image pixel data.
- **Pso<#>** - Contains information about the hardcopy layout on which the images is supposed to be printed. Initially this file may be empty as well.

Please note that the relation between the patient demographics and the files is only known in the database. The numbering does not give any relation between the files (i.e. same numbers do not necessarily mean same Procedure Step).